

Fishery Data Series No. 13-19

Assessment of the Togiak River Chinook Salmon Sport Fishery, 2007

by

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Alaska Department of Fish and Game

Divisions of Sport Fish and Commercial Fisheries



Symbols and Abbreviations

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Weights and measures (metric)		General		Measures (fisheries)	
centimeter	cm	Alaska Administrative Code	AAC	fork length	FL
deciliter	dL	all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.	mid-eye to tail fork	METF
gram	g			standard length	SL
hectare	ha			total length	TL
kilogram	kg	all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.	Mathematics, statistics	
kilometer	km			<i>all standard mathematical signs, symbols and abbreviations</i>	
liter	L	at	@	alternate hypothesis	H _A
meter	m	compass directions:		base of natural logarithm	<i>e</i>
milliliter	mL	east	E	catch per unit effort	CPUE
millimeter	mm	north	N	coefficient of variation	CV
		south	S	common test statistics (F, t, χ^2 , etc.)	
		west	W	confidence interval	CI
		copyright	©	correlation coefficient (multiple)	R
		corporate suffixes:		correlation coefficient (simple)	r
		Company	Co.	covariance	cov
		Corporation	Corp.	degree (angular)	°
		Incorporated	Inc.	degrees of freedom	df
		Limited	Ltd.	expected value	<i>E</i>
		District of Columbia	D.C.	greater than	>
		et alii (and others)	et al.	greater than or equal to	≥
		et cetera (and so forth)	etc.	harvest per unit effort	HPUE
		exempli gratia (for example)	e.g.	less than	<
		Federal Information Code	FIC	less than or equal to	≤
		id est (that is)	i.e.	logarithm (natural)	ln
		latitude or longitude	lat. or long.	logarithm (base 10)	log
		monetary symbols (U.S.)	\$, ¢	logarithm (specify base)	log ₂ , etc.
		months (tables and figures): first three letters	Jan.,...,Dec	minute (angular)	'
		registered trademark	®	not significant	NS
		trademark	™	null hypothesis	H ₀
		United States (adjective)	U.S.	percent	%
		United States of America (noun)	USA	probability	P
		U.S.C.	United States Code	probability of a type I error (rejection of the null hypothesis when true)	α
		U.S. state	use two-letter abbreviations (e.g., AK, WA)	probability of a type II error (acceptance of the null hypothesis when false)	β
				second (angular)	"
				standard deviation	SD
				standard error	SE
				variance	
				population sample	Var
					var
Weights and measures (English)					
cubic feet per second	ft ³ /s				
foot	ft				
gallon	gal				
inch	in				
mile	mi				
nautical mile	nmi				
ounce	oz				
pound	lb				
quart	qt				
yard	yd				
Time and temperature					
day	d				
degrees Celsius	°C				
degrees Fahrenheit	°F				
degrees kelvin	K				
hour	h				
minute	min				
second	s				
Physics and chemistry					
all atomic symbols					
alternating current	AC				
ampere	A				
calorie	cal				
direct current	DC				
hertz	Hz				
horsepower	hp				
hydrogen ion activity (negative log of)	pH				
parts per million	ppm				
parts per thousand	ppt, ‰				
volts	V				
watts	W				

FISHERY DATA SERIES NO. 13-19

**ASSESSMENT OF TOGIAK RIVER CHINOOK SALMON SPORT
FISHERY, 2007**

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TABLE OF CONTENTS

	Page
LIST OF TABLES.....	ii
LIST OF FIGURES.....	ii
LIST OF APPENDICES	ii
ABSTRACT	1
INTRODUCTION.....	1
Objectives.....	2
Tasks.....	2
METHODS.....	3
Study Area.....	3
Study Design	4
Angler Interviews	4
Biological Composition	5
Angler Effort Index.....	5
Data Collection.....	5
Angler Interviews	5
Biological Composition	5
Angler Effort Index.....	5
Data Analysis.....	6
Distribution of Catch Success.....	6
Percentages of Angler-trips by Terminal Tackle Type and Angler Type.....	6
Assumptions	7
Biological Composition	7
Angler Effort.....	7
RESULTS.....	7
Angler Characteristics	8
Angler Success	9
Biological Composition.....	9
DISCUSSION.....	10
ACKNOWLEDGMENTS	11
REFERENCES CITED	12
APPENDIX A: DAILY ANGLER COUNTS	15

LIST OF TABLES

Table	Page
1. Number and percent of angler trips by angler and gear type during the Chinook salmon sport fishery on the lower Togiak River, 1 July to 18 July 2007.....	8
2. Distributions of catch and harvest by trips during the Chinook salmon sport fishery on the Togiak River, 1 July to 18 July 2007.....	9
3. Mean lengths (mm) and weights (kg) of Chinook salmon, by sex and age group, from samples collected from the lower Togiak River sport harvest, 1 July to 18 July 2007.	10

LIST OF FIGURES

Figure	Page
1. Popular Chinook salmon fisheries in the Bristol Bay Management Area (outlined) including the Togiak River with survey area marked.....	2
2. Togiak River drainage of Southwest Alaska with boundary of the Togiak National Wildlife Refuge (upper survey boundary).	3

LIST OF APPENDICES

Appendix	Page
A1. Angler counts by day on the lower Togiak River, 28 June to 19 July 2007.....	16

ABSTRACT

A creel survey of the Chinook salmon sport fishery on the lower Togiak River in Southwest Alaska was conducted from 28 June through 19 July 2007 to monitor the sport fishery and to compare with surveys conducted previously. Anglers were interviewed for information on catch, effort, use of guide services, and demographic characteristics. Age, sex, length, and weight data were collected from Chinook salmon harvested by anglers. During the survey, 273 anglers were interviewed. Most anglers were guided (86%, SE 2.1%) and not residents of Alaska (94%, SE 1.5%). A majority of anglers used spin gear (61%, SE 3.0%), followed by bait (31%, SE 2.8%), fly gear (6%, SE 1.4%), and combinations of spin and fly (2%, SE 0.8%) and spin and bait (1%, SE 0.5%). The average length of sampled Chinook salmon was 833 mm (SE 9.5 mm) and the average weight was 10.7 kg (SE 0.3 mm). The predominant ages were 1.4 (64%) and 1.3 (24%).

Keywords: Chinook salmon, *Oncorhynchus tshawytscha*, Togiak River, catch rates, angler characteristics, biological composition.

INTRODUCTION

The Bristol Bay Management Area (BBMA) supports several important Chinook salmon sport fisheries, notably in the Alagnak, Naknek, Nushagak, and Togiak rivers (Figure 1). The Alaska Department of Fish and Game (ADF&G) regularly monitors and evaluates these major fisheries because of their popularity.

Many of the sport fisheries in the BBMA are monitored by the ADF&G Division of Sport Fish annual statewide harvest mail survey (Mills 1979-1980, 1981a-b, 1982-1994; Howe et al. 1995, 1996, 2001a-d; Walker et al. 2003; Jennings et al. 2004, 2006a-b, 2007, 2009a-b, 2010). However, some information can only be supplied by on-site work: timely estimates of effort, catch and harvest by geographic segments of a sport fishery, assessments of angler practices and characteristics, and data collection from sport harvested fish. Angler creel surveys assessing sport effort, catch, and harvest, and biological characteristics of the Chinook salmon sport harvest on the Togiak River have occurred since the 1980s: 1984 (Minard and Lisac 1984), 1989 (Dunaway 1990), 1990 (Dunaway and Bingham 1991), and 1998 (Gryska and Naughton 2000).

In addition to sport fishing, the Togiak River Chinook salmon stock is also subjected to commercial and subsistence fishing. The commercial and subsistence harvests are estimated annually by the ADF&G Division of Commercial Fisheries and published in their Annual Management Report (AMR) series for the Bristol Bay Management Area.

There has only been one change in the sport fishing regulations since the Togiak River sport fishery was last surveyed in 1998. In 2003, it became illegal to remove a Chinook salmon from the water if it was not intended for harvest. From 1998 to 2003, estimated sport fishing effort was stable at approximately 4,500 angler-days per year (Howe et al. 2001c-d; Walker et al. 2003; Jennings et al. 2004, 2006a-b); however, during 2004 and 2005, effort on the Togiak River increased to an average 6,200 angler-days (Jennings et al. 2007, 2009a). Estimates of sport effort, angler characteristics, catch, and harvest of Chinook salmon on the lower Togiak River were obtained in 2007 to monitor the sport fishery and to compare with surveys conducted previously.

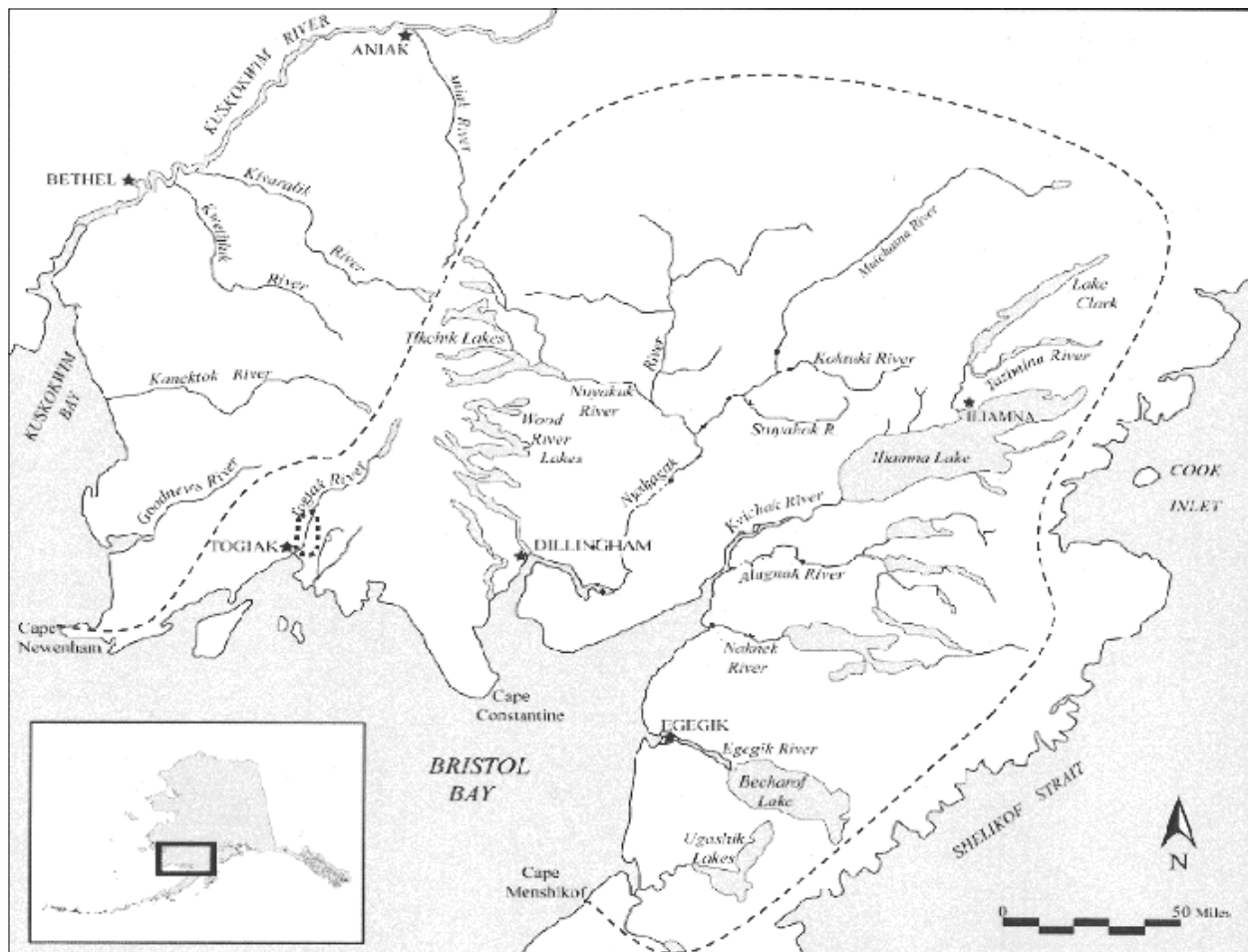


Figure 1.—Popular Chinook salmon fisheries in the Bristol Bay Management Area (outlined) including the Togiak River with survey area marked.

OBJECTIVES

The objectives for the 2007 creel survey on the Togiak River Chinook salmon sport fishery were germane to the lower 38 km of the river during 28 June through 19 July (Figure 2).

The objectives were as follows:

- 1) Estimate the distribution of catch and harvest among Chinook salmon anglers by angler-day.
- 2) Estimate the percentage of angler-trips by terminal tackle type (flies, bait, or spinning) and angler type (residency, guided, unguided, guides).
- 3) Estimate the age, sex, length, and weight compositions of Chinook salmon harvested in the sport fishery.

TASKS

In addition to the objectives described above, the following task was accomplished:

- 1) Index daily angler effort during each sampled day in the survey area.

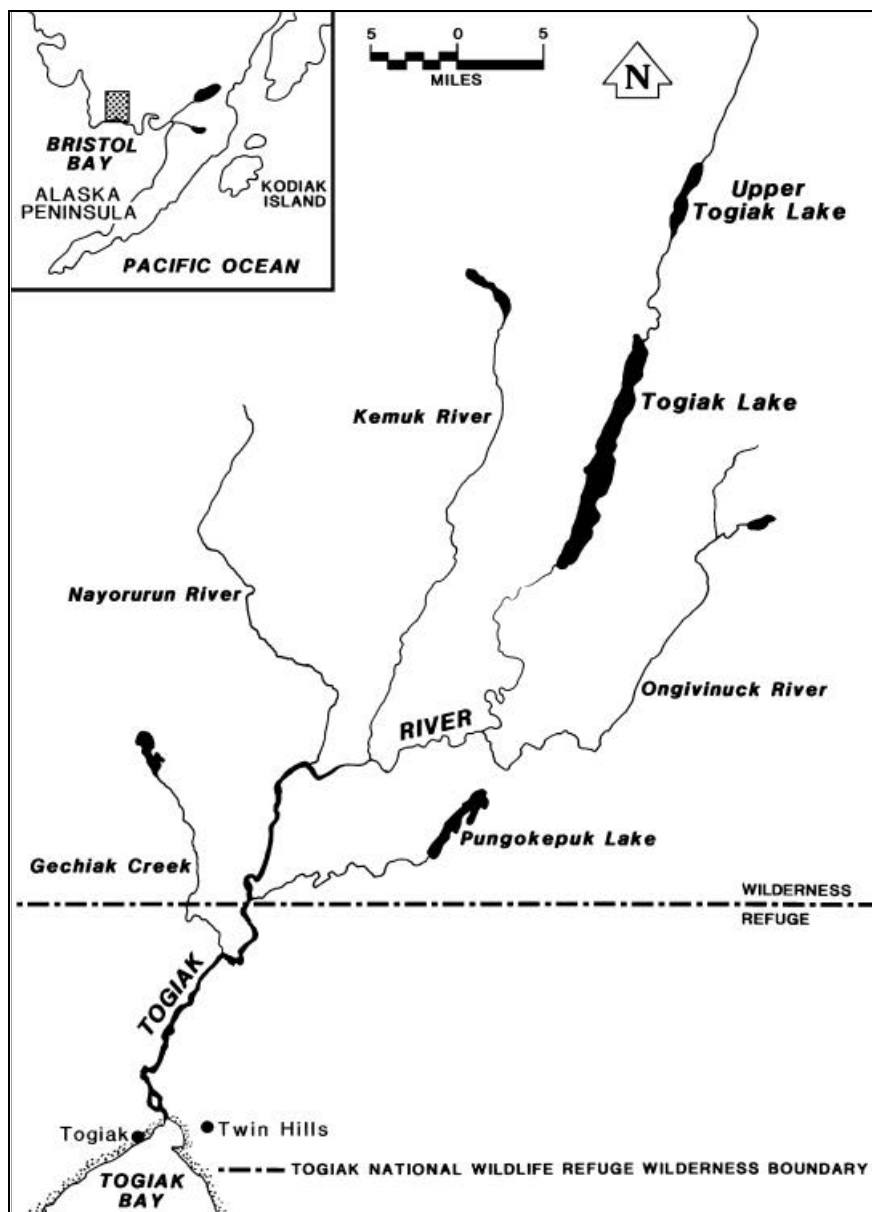


Figure 2.—Togiak River drainage of Southwest Alaska with boundary of the Togiak National Wildlife Refuge (upper survey boundary).

METHODS

STUDY AREA

The Togiak River flows south into Bristol Bay at the village of Togiak, about 104 km west of Dillingham (Figure 1). Much of the Togiak River is within the Togiak National Wildlife Refuge (TNWR) and the uplands within the refuge are managed by the United States Fish and Wildlife Service (USFWS). The survey area for this report extended along the lower 38 km of the river from the TNWR wilderness boundary to the mouth of the river.

STUDY DESIGN

The Togiak River Chinook salmon fishery study was conducted from 28 June to 19 July 2007. The location and time period were selected to ensure the creel survey would be conducted during the peak of the Chinook salmon sport fishery. The peak fishing period was determined from angler counts recorded during previous surveys (Minard and Lisac 1984; Dunaway and Bingham 1991; Gryska and Naughton 2000).

Angler Interviews

A systematic roving fishery survey was conducted on the lower Togiak River to sample the Chinook salmon sport fishery (i.e., to conduct angler interviews and sample the sport harvest for biological data). Angler interviews were conducted from 1 July to 18 July. In the study site, it was presumed that every angler who fished during the sampling day would be interviewed (sampled). The angler interview information was used to estimate the distribution of angler catches (Objective 1). Information was collected during the interviews to provide estimates of the percentages of angler-trips by residency, use of guides, and terminal tackle choices (Objective 2). The “distribution of catches by angler-day” was defined as the proportion of angler-days that resulted in catches of 1 or more Chinook salmon, 2 or more Chinook salmon, etc. The “distribution of harvest by angler-day” was defined similarly.

A self-weighted roving survey conducted on a systematic sampling schedule was the basis of the Togiak River study. During the study period, survey technicians worked 5-day weeks (Sunday–Thursday), spending 7 hours per day interviewing sport anglers and sampling harvested Chinook salmon. An effort was made to make 3 passes through the fishery during each sampling day within the allotted 7-hour period. It was assumed that every angler fishing during the 7-hour sampling period could be interviewed on a given sampling day.

Previous survey data from the Togiak River indicated that peak angler counts occurred from midmorning through early evening (Minard and Lisac 1984; Dunaway 1990; Gryska and Naughton 2000). For the planned roving survey, the sampling day was a 7-hour period from 1000 hours to 1700 hours.

Bernard et al. (1998) reported that fishery attributes, such as composition of harvest and distribution of catch, can be estimated without stratification, stratum weights, stages, or sample weights if the sampling is self-weighting. Self-weighting, in this case, implied that sampling was conducted such that an equal fraction of anglers was interviewed on a given sample day and an equal fraction was interviewed throughout the fishing season.

Both completed-trip angler interviews (anglers who had suspended fishing for the day) and incomplete-trip interviews were conducted by the technicians as they passed through the fishery. Only completed-trip information was used to obtain the catch success distribution estimates and the technicians concentrated on getting completed trip interviews. Both completed-trip and incomplete-trip information were used to estimate the percentages of angler-trips by terminal tackle type and by angler type.

The parameters estimated for objectives 1 and 2 were multinomial percentages. These percentages applied either to the categories associated with the angler-day or trip of interviewed anglers (e.g., percentages of angler-trips for anglers that used fly gear). All percentages were calculated as if the information (interviews) were collected from a simple random sample.

Biological Composition

Age, sex, length, and weight were measured for all sport harvested Chinook salmon encountered during the interview process. This information was used to estimate the age, sex, length, and weight compositions of the Chinook salmon sport harvest (Objective 3).

Angler Effort Index

One angler count was conducted at the same time of day during each sampled day from 28 June to 19 July to address Task 1. Accordingly, the count *could not* be used to estimate angler effort for the fishery because all possible count times were not surveyed.

DATA COLLECTION

Angler Interviews

Angler interviews consisted of obtaining catch, harvest, angler-type (guided, unguided, guides), terminal tackle, and general demographic information from anglers encountered in the fishery. Both completed-trip angler interviews (anglers who had suspended fishing for the day) and incomplete-trip interviews were collected. Every effort was made to interview anglers who had completed fishing for the day (completed-trip interviews).

Survey technicians attempted to distribute their interview effort uniformly among all angling groups, geographically through the survey area, and uniformly over time during each sampling day. Every effort was made to interview a uniform proportion, and preferably high proportion (nearly 100%) of the anglers present on a given sampling day.

Biological Composition

Sport harvested Chinook salmon encountered during the angler interview portion of the angler surveys were measured to the nearest millimeter for mid eye to tail fork (METF) length, weighed to the nearest 0.1 or 0.25 kilograms (depending upon scale used), and sex was determined based on external characteristics (protruding ovipositor for females or developing kype for males). In addition, 3 scales were removed from the preferred area¹ and mounted on an adhesive-coated card. Adhesive-coated cards were pressed against acetate cards in a heated hydraulic press and the resulting scale impressions displayed on a microfiche projector for age determination². Standard age determination procedures were used (see Jearld 1983 for a general description of the principles used).

Angler Effort Index

A single daily angler count was used to index fishing effort. Angler counts took no longer than 75 minutes to conduct and represented angler effort at the time the count was conducted. The starting time for the daily count was 1045 hours. Once at the starting point, the survey technician counted all active anglers while navigating the boat at a constant rate of speed through the fishery to the far boundary of the study area. Active anglers were people who were handling or

¹ From the left side of the fish approximately 2 rows above the lateral line and on a diagonal line downward from the posterior insertion of the dorsal fin to the anterior insertion of the anal fin (Welander 1940).

² For salmon, the numeral preceding the decimal is the number of freshwater annuli, whereas the numeral following the decimal is the number of marine annuli (European method). Total age from brood year is the sum of the two numerals plus one.

using fishing rods and tackle, including people who may have interrupted their fishing to reposition their boat, land a fish, repair their gear (tie on a new lure, fix a tangle, etc.), or assist another person with their fishing activities. An active angler did not include a boat operator who was not operating fishing gear, or include a person who put away their gear to eat lunch or to engage in some other activity not associated with angling.

DATA ANALYSIS

As noted above, the parameters estimated for objectives 1 and 2 were multinomial percentages and were calculated as if the information (interviews) were collected from a simple random sample. The following subsections outline the specific procedures used to calculate these estimates.

Distribution of Catch Success

The “distribution of catch” was defined as the fraction p_g of angler-days in which g or more fish were caught, where g is expressed as $g = 1$ to g_{max} . If $g_{max} = 10$, then 1 set of data was analyzed 10 times to obtain all possible fractions p_g in a set. Additionally, p_0 was defined as the proportion of angler-days with a catch of zero fish (by species). As noted above, only completed-trip interviews were used to estimate these proportions. Because the distribution of angler catch was not expected to vary within the study period, the simpler procedures outlined by Bernard et al. (1998) were used to calculate these statistics.

The proportions and their variances were calculated as follows:

$$\hat{p}_g = \frac{\sum_{i=1}^d y_{gi}}{m} \quad (1)$$

$$\hat{V}[\hat{p}_g] = \frac{\hat{p}_g(1 - \hat{p}_g)}{m - 1} \quad (2)$$

where y_{gi} is the number of interviewed completed-trip anglers in each sampled day whose catch put them into category g (for example, y_{7i} for the estimate of p_7 for catch would be the number of anglers interviewed that caught 7 or more Chinook salmon), d is the number of days sampled, and m is the total number of completed-trip interviews, calculated as follows:

$$m = \sum_{i=1}^d m_i \quad (3)$$

where m_i equals the number of completed-trip interviews within each sampled day.

Percentages of Angler-trips by Terminal Tackle Type and Angler Type

Estimates of the percentages of angler-trips by terminal tackle type (flies, bait, or spinning) or by angler type (guided, unguided, or guides) were obtained in a similar manner to that described above for the distributions of catch success. The primary differences in the calculations were 1) different categories were used for g in equation 1, and 2) all interviews (both completed-trip and incomplete-trip) were used in the calculations.

Assumptions

The assumptions necessary for unbiased point and variance estimates for the various parameters obtained by the procedures outlined above include the following:

- 1) Interviewed anglers accurately reported the number of fish released by species.
- 2) The creel technician accurately classified anglers and the interviewed anglers accurately reported their residency, trip type (guided, unguided, versus guides), and the terminal tackle type used during their fishing trip.
- 3) Catch rate and duration of fishing trip were independent (DiCostanzo 1956). (Because anglers with longer fishing trips have a greater probability of being intercepted for an interview, a roving method of interviewing was necessary to mitigate this in order to satisfy the assumption).

There are no direct ways of evaluating or testing the first two assumptions. Anglers were expected to have fairly good recollection of the total number of fish caught. Similarly, anglers were expected to accurately report their fishing trip characteristics (Assumption 2).

Estimates of the distribution of catches were constrained to completed-trip interviews, thus addressing the third assumption.

All parameter estimates were only representative of the fishery as surveyed: the fishing activity occurring on the Togiak River between 1000 hours to 1700 hours during the days of the survey.

Biological Composition

The proportion of harvested Chinook salmon that were age u was estimated as follows:

$$\hat{p}_u = \frac{n_u}{n} \quad (4)$$

where n_u equals the number of the sampled Chinook salmon harvested that were age u and n equals the total number of Chinook salmon sampled during the survey.

For samples collected during the survey, $\hat{V}[\hat{p}_u]$ was calculated without the finite population correction factor because we did not have a harvest estimate for this site:

$$\hat{V}[\hat{p}_u] \approx \frac{\hat{p}_u(1 - \hat{p}_u)}{n - 1}. \quad (5)$$

Mean length-at-age as well as mean weight of harvested Chinook salmon were estimated following standard procedures (Sokal and Rohlf 1981: Boxes 4.2 and 7.1, pages 56 and 139).

Angler Effort

As noted above, the single angler count conducted each day represented an index of angler effort.

RESULTS

During the 2007 Togiak River Chinook salmon creel survey, 273 interviews were conducted from 1 July to 18 July. Of the 273 interviews, 174 were from anglers that had completed their fishing trip for the day. The remaining 99 interviews were from anglers that had not completed their fishing trip for the day. The sampling goal of 300 interviews to estimate distribution of

catches was not met. However, the sampling goal for estimating angler parameters was met. Angler index counts were conducted from 28 June through 19 July for an average count of 31 anglers (SE 2.8) with a range from 11 anglers on 28 June to 50 anglers on 10 July (Appendix A1).

ANGLER CHARACTERISTICS

Of the 273 interviews, approximately 85.7% (SE 2.1%) of the anglers were guided, 14.3% (SE 2.1%) were unguided and none were guides who were fishing (Table 1). Most anglers were not residents of Alaska (93.8%, SE 1.5%) and 1.5% (SE 0.7%) were residents of another country. Most anglers were adult (99%, SE 0.7%) and most were male (94.5%, SE 1.4%). Most anglers exclusively used spinning gear (60.8%, SE 3.0%) followed by bait (30.8%, SE 2.8%) and flies (5.9%, SE 1.4%). A combination of spinning and fly gear was used by 1.8% (SE 0.8%) of the anglers and the combination of spinning tackle and bait was used by less than 1% (SE 0.5%) of anglers.

Table 1.—Number and percent of angler trips by angler and gear type during the Chinook salmon sport fishery on the lower Togiak River, 1 July to 18 July 2007.

Characteristic	Angler trips	Percent
Angler type		
Guided	234	85.7
Unguided	39	14.3
Guide who is fishing	0	0
Residency		
Alaskan residents	18	6.2
Local Alaskan residents ^a	5	1.8
Nonlocal Alaskan residents ^b	12	4.4
Non-Alaskan residents	256	93.8
U.S. resident	252	92.3
Non-U.S. resident	4	1.5
Gender		
Male	258	94.5
Female	30	5.5
Tackle type		
Spin	166	60.8
Bait	91	30.8
Fly	16	5.9
Spin and fly	5	1.8
Spin and bait	2	0.7
Total Angler Trips	273	

^a Alaskan resident living in Togiak and Twin Hills area.

^b All other Alaskan residents.

ANGLER SUCCESS

Between 1 July and 18 July, total Chinook salmon catch was 1,770 and harvest was 222 fish. Total sport fishing effort was 1,475 angler-hours for a catch per unit effort of 1.23 fish/h.

Anglers caught at least 1 Chinook salmon during 82% (SE 0.02%) of the fishing trips, and 58% (SE 0.03%) of those trips resulted in the harvest of at least 1 fish (Table 2). Of all anglers, 22% (SE 0.03%) harvested 2 or more Chinook salmon and 1% (SE 0.01%) reported harvesting a bag limit of 3 Chinook salmon.

Table 2.—Distributions of catch and harvest by trips during the Chinook salmon sport fishery on the Togiak River, 1 July to 18 July 2007.

Catch (released + kept)					Harvest				
Number of fish	Angler-trips	Percent of trips	95% CI		Number of fish	Angler-trips	Percent of trips	95% CI	
			Lower	Upper				Lower	Upper
0	50	18	14	23	0	114	42	36	48
1+	223	82	77	86	1+	159	58	52	64
2+	199	73	68	78	2+	61	22	17	27
3+	185	68	62	73	3+	2	1	1	2
4+	169	62	56	68					
5+	146	53	48	59					
6+	126	46	40	52					
7+	109	40	34	46					
8+	95	35	29	40					
9+	83	30	25	36					
10+	70	26	20	31					
11+	61	22	17	27					
12+	54	20	15	25					
13+	45	16	12	21					
14+	38	14	10	18					
15+	37	14	9	18					
16+	29	11	7	14					

Note: Percentages do not add to 100% because they describe the proportion of total angler trips (273) that resulted in catches of zero Chinook salmon, or 1 or more Chinook salmon, 2 or more Chinook salmon, etc. The proportion of total angler trips (273) that resulted in harvest was defined similarly.

BIOLOGICAL COMPOSITION

Biological data were collected from 173 harvested Chinook salmon of which 160 scale samples could be aged (Table 3). Females composed 58% (SE 0.04%) of the harvest (Table 3). The predominant age groups among all fish sampled were age 1.4 (64%, SE 0.04%) and age 1.3 (24%, SE 0.03%). Overall average length was 833 mm (SE 9.6 mm) and overall average weight was 10.7 kg (SE 0.3 kg).

Table 3.—Mean lengths (mm) and weights (kg) of Chinook salmon, by sex and age group, from samples collected from the lower Togiak River sport harvest, 1 July to 18 July 2007.

	Age Group						
	Unknown	1.1	1.2	1.3	1.4	1.5	Total
<u>Females</u>							
Proportion				0.17	0.41		0.58
SE				0.06	0.04		0.04
Sample size				27	66		93
Mean length (mm)	878			816	879		862
SE	18.3			8.3	5.7		5.3
Sample size	7			27	66		100
Mean weight (kg)	11.4			9.4	11.6		11.0
SE	0.8			0.3	0.3		0.2
Sample size	7			27	66		100
<u>Males</u>							
Proportion		0.01	0.09	0.08	0.23	0.01	0.42
SE		0.01	0.02	0.02	0.03	0.01	0.04
Sample size		2	14	12	37	2	67
Mean length (mm)	801	373	537	777	907	983	793
SE	67.9	12.0	17.3	26.5	9.7	19.5	20.6
Sample size	6	2	14	12	37	2	73
Mean weight (kg)	10.2	1.1	3.0	8.7	13.6	16.2	10.2
SE	2.3	0.0	0.3	0.7	0.5	0.7	0.6
Sample size	6	2	14	12	37	2	73
<u>All Samples</u>							
Proportion		0.01	0.09	0.24	0.64	0.01	1.00
SE		0.01	0.02	0.03	0.04	0.01	
Sample size		2	14	39	103	2	160
Mean length (mm)	833	373	537	804	889	983	833
SE	33.1	12.0	17.3	10.2	5.2	19.5	9.6
Sample size	13	2	14	39	103	2	173
Mean weight (kg)	10.8	1.1	3.0	9.2	12.3	16.2	10.7
SE	1.1	0.0	0.3	0.3	0.3	0.7	0.3
Sample size	13	2	14	39	103	2	173

DISCUSSION

The Chinook salmon fishery on the lower Togiak River was surveyed in 1990 (Dunaway and Bingham 1991) and more recently in 1998 (Gryski and Naughton 2000). Angler characteristics were not estimated in 1990. However in 1998 and 2007, the estimates of guided and nonresident anglers were very similar; in both years most of the interviewed anglers were guided nonresidents. The percentage of anglers from foreign countries was higher in 1998 (14%) than in 2007 (1%). This discrepancy may be attributed to a decrease in booking of foreign anglers at one of the local lodges in 2007. Spinning gear was most commonly used followed by bait in both years. However, fly gear was used more often in 1998 than in 2007.

The average number of anglers counted in 2007 was 7 more than in 1998 during the same days that counts were conducted. Although angler counts could not be used to directly estimate angler effort for the fishery because all possible count times were not surveyed, the counts were

conducted at the same time of day in both surveys, indicating that the number of anglers participating in the fishery has increased since 1998, which is consistent with increased effort documented by the SWHS (see Introduction).

In 1990 and 1998, over half of harvested Chinook salmon were male, while in 2007, females composed over half of the harvest. This may be attributed to an increase in the use of bait by anglers in 2007 (tackle type was nearly 10% more bait in 2007), which may have increased the demand to harvest females for roe. The age composition of harvested Chinook salmon during all years was dominated by age-1.4 fish. The average size of Chinook salmon was smallest in 1990 at 738 mm (SE 20 mm) while average size was similar in 1998 (819 mm, SE 8.9 mm) and 2007 (833 mm, SE 9.6 mm) (Dunaway and Bingham 1991; Gryska and Naughton 2000).

The surveys in 1990, 1998, and 2007 documented guided nonresidents as the largest sport angling segment and documented the size and age composition of the Chinook salmon sport harvest. Little has changed in the fishery since it was last surveyed 9 years ago and due to the remote location of the fishery, it is unlikely that an increase in nonguided anglers or a change in the harvest composition will occur. This fishery will likely remain a predominantly nonresident guided fishery with clients that select for large Chinook salmon. Because this fishery is not expected to change much in the future, monitoring of angler characteristics and catch composition is not advised for some time. If management issues arise in the future, the fishery should be reexamined.

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REFERENCES CITED

- Bernard, D. R., A. E. Bingham, and M. Alexandersdottir. 1998. The mechanics of onsite creel surveys in Alaska. Alaska Department of Fish and Game, Special Publication No. 98-01, Anchorage. <http://www.adfg.alaska.gov/FedAidPDFs/sp98-01.pdf>
- DiCostanzo, D. J. 1956. Creel census techniques and harvest of fishes in Clear Lake, Iowa. Iowa State College, Ph.D. dissertation, Ames, Iowa.
- Dunaway, D. O. 1990. Creel and escapement statistics for the Togiak River during 1989. Alaska Department of Fish and Game, Fishery Data Series No. 90-26, Anchorage. <http://www.adfg.alaska.gov/FedAidPDFs/fds90-26.pdf>
- Dunaway, D. O., and A. E. Bingham. 1991. Effort, catch, harvest, and escapement statistics for the Chinook salmon sport fishery in the lower Togiak River, Alaska, during 1990. Alaska Department of Fish and Game, Fishery Data Series No. 91-10, Anchorage. <http://www.adfg.alaska.gov/FedAidPDFs/fds91-10.pdf>
- Gryska, A. D., and G. P. Naughton. 2000. Surveys of the 1998 Chinook and 1999 coho salmon sport fisheries in the lower Togiak River, Alaska. Alaska Department of Fish and Game, Fishery Data Series No. 00-42, Anchorage. <http://www.adfg.alaska.gov/FedAidPDFs/fds00-42.pdf>
- Howe, A. L., G. Fidler, A. E. Bingham, and M. J. Mills. 1996. Harvest, catch, and participation in Alaska sport fisheries during 1995. Alaska Department of Fish and Game, Fishery Data Series No. 96-32, Anchorage. <http://www.adfg.alaska.gov/FedAidPDFs/fds96-32.pdf>
- Howe, A. L., G. Fidler, and M. J. Mills. 1995. Harvest, catch, and participation in Alaska sport fisheries during 1994. Alaska Department of Fish and Game, Fishery Data Series No. 95-24, Anchorage. <http://www.adfg.alaska.gov/FedAidPDFs/fds95-24.pdf>
- Howe, A. L., R. J. Walker, C. Olnes, K. Sundet, and A. E. Bingham. 2001a. Revised Edition. Harvest, catch, and participation in Alaska sport fisheries during 1996. Alaska Department of Fish and Game, Fishery Data Series No. 97-29 (revised), Anchorage. [http://www.adfg.alaska.gov/FedAidPDFs/fds97-29\(revised\).pdf](http://www.adfg.alaska.gov/FedAidPDFs/fds97-29(revised).pdf)
- Howe, A. L., R. J. Walker, C. Olnes, K. Sundet, and A. E. Bingham. 2001b. Revised Edition. Harvest, catch, and participation in Alaska sport fisheries during 1997. Alaska Department of Fish and Game, Fishery Data Series No. 98-25 (revised), Anchorage. [http://www.adfg.alaska.gov/FedAidPDFs/fds98-25\(revised\).pdf](http://www.adfg.alaska.gov/FedAidPDFs/fds98-25(revised).pdf)
- Howe, A. L., R. J. Walker, C. Olnes, K. Sundet, and A. E. Bingham. 2001c. Revised Edition. Participation, catch, and harvest in Alaska sport fisheries during 1998. Alaska Department of Fish and Game, Fishery Data Series No. 99-41 (revised), Anchorage. [http://www.adfg.alaska.gov/FedAidPDFs/fds99-41\(revised\).pdf](http://www.adfg.alaska.gov/FedAidPDFs/fds99-41(revised).pdf)
- Howe, A. L., R. J. Walker, C. Olnes, K. Sundet, and A. E. Bingham. 2001d. Participation, catch, and harvest in Alaska sport fisheries during 1999. Alaska Department of Fish and Game, Fishery Data Series No. 01-08, Anchorage. <http://www.adfg.alaska.gov/FedAidPDFs/fds01-08.pdf>
- Jearld, A., Jr. 1983. Age determination. Pages 301-324 in L. A. Nielsen, editors. Fisheries techniques. The American Fisheries Society, Bethesda, Maryland
- Jennings, G. B., K. Sundet, and A. E. Bingham. 2007. Participation, catch, and harvest in Alaska sport fisheries during 2004. Alaska Department of Fish and Game, Fishery Data Series No. 07-40, Anchorage. <http://www.adfg.alaska.gov/FedAidPDFs/fds07-40.pdf>
- Jennings, G. B., K. Sundet, and A. E. Bingham. 2009a. Estimates of participation, catch, and harvest in Alaska sport fisheries during 2005. Alaska Department of Fish and Game, Fishery Data Series No. 09-47, Anchorage. <http://www.adfg.alaska.gov/FedAidPDFs/FDS09-47.pdf>
- Jennings, G. B., K. Sundet, and A. E. Bingham. 2009b. Estimates of participation, catch, and harvest in Alaska sport fisheries during 2006. Alaska Department of Fish and Game, Fishery Data Series No. 09-54, Anchorage. <http://www.adfg.alaska.gov/FedAidPDFs/FDS09-54.pdf>
- Jennings, G. B., K. Sundet, and A. E. Bingham. 2010. Estimates of participation, catch, and harvest in Alaska sport fisheries during 2007. Alaska Department of Fish and Game, Fishery Data Series No. 10-02, Anchorage. <http://www.adfg.alaska.gov/FedAidpdfs/Fds10-02.pdf>

REFERENCES CITED (Continued)

- Jennings, G. B., K. Sundet, A. E. Bingham, and D. Sigurdsson. 2004. Participation, catch, and harvest in Alaska sport fisheries during 2001. Alaska Department of Fish and Game, Fishery Data Series No. 04-11, Anchorage. <http://www.adfg.alaska.gov/FedAidPDFs/fds04-11.pdf>
- Jennings, G. B., K. Sundet, A. E. Bingham, and D. Sigurdsson. 2006a. Participation, catch, and harvest in Alaska sport fisheries during 2002. Alaska Department of Fish and Game, Fishery Data Series No. 06-34, Anchorage. <http://www.adfg.alaska.gov/FedAidpdfs/fds06-34.pdf>
- Jennings, G. B., K. Sundet, A. E. Bingham, and D. Sigurdsson. 2006b. Participation, catch, and harvest in Alaska sport fisheries during 2003. Alaska Department of Fish and Game, Fishery Data Series No. 06-44, Anchorage. <http://www.adfg.alaska.gov/FedAidpdfs/fds06-44.pdf>
- Mills, M. J. 1979. Alaska statewide sport fish harvest studies. Alaska Department of Fish and Game, Federal Aid in Fish Restoration, Annual Performance Report 1978-1979, Project F-9-11(20)SW-I-A, Juneau. [http://www.adfg.alaska.gov/FedAidPDFs/FREDf-9-11\(20\)SW-I-A.pdf](http://www.adfg.alaska.gov/FedAidPDFs/FREDf-9-11(20)SW-I-A.pdf)
- Mills, M. J. 1980. Alaska statewide sport fish harvest studies. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1979-1980, Project F-9-12(21) SW-I-A, Juneau. [http://www.adfg.alaska.gov/FedAidPDFs/FREDf-9-12\(21\)SW-I-A.pdf](http://www.adfg.alaska.gov/FedAidPDFs/FREDf-9-12(21)SW-I-A.pdf)
- Mills, M. J. 1981a. Alaska statewide sport fish harvest studies. 1979 data. Alaska Department of Fish and Game, Federal Aid in Fish Restoration, Annual Performance Report 1980-1981, Project F-9-13(22a)SW-I-A, Juneau. [http://www.adfg.alaska.gov/FedAidPDFs/FREDf-9-13\(22a\)SW-I-A.pdf](http://www.adfg.alaska.gov/FedAidPDFs/FREDf-9-13(22a)SW-I-A.pdf)
- Mills, M. J. 1981b. Alaska statewide sport fish harvest studies. 1980 data. Alaska Department of Fish and Game, Federal Aid in Fish Restoration, Annual Performance Report 1980-1981, Project F-9-13(22b)SW-I-A, Juneau. [http://www.adfg.alaska.gov/FedAidPDFs/FREDf-9-13\(22b\)SW-I-A.pdf](http://www.adfg.alaska.gov/FedAidPDFs/FREDf-9-13(22b)SW-I-A.pdf)
- Mills, M. J. 1982. Alaska statewide sport fish harvest studies. Alaska Department of Fish and Game, Federal Aid in Fish Restoration, Annual Performance Report 1981-1982, Project F-9-14(23)SW-I-A, Juneau. [http://www.adfg.alaska.gov/FedAidPDFs/FREDf-9-14\(23\)SW-I-A.pdf](http://www.adfg.alaska.gov/FedAidPDFs/FREDf-9-14(23)SW-I-A.pdf)
- Mills, M. J. 1983. Alaska statewide sport fish harvest studies. Alaska Department of Fish and Game, Federal Aid in Fish Restoration, Annual Performance Report 1982-1983, Project F-9-15(24)SW-I-A, Juneau. [http://www.adfg.alaska.gov/FedAidPDFs/FREDf-9-15\(24\)SW-I-A.pdf](http://www.adfg.alaska.gov/FedAidPDFs/FREDf-9-15(24)SW-I-A.pdf)
- Mills, M. J. 1984. Alaska statewide sport fish harvest studies. Alaska Department of Fish and Game, Federal Aid in Fish Restoration, Annual Performance Report 1983-1984, Project F-9-16(25)SW-I-A, Juneau. [http://www.adfg.alaska.gov/FedAidPDFs/FREDf-9-16\(25\)SW-I-A.pdf](http://www.adfg.alaska.gov/FedAidPDFs/FREDf-9-16(25)SW-I-A.pdf)
- Mills, M. J. 1985. Alaska statewide sport fish harvest studies. Alaska Department of Fish and Game, Federal Aid in Fish Restoration, Annual Performance Report 1984-1985, Project F-9-17(26)SW-I-A, Juneau. [http://www.adfg.alaska.gov/FedAidPDFs/FREDf-9-17\(26\)SW-I-A.pdf](http://www.adfg.alaska.gov/FedAidPDFs/FREDf-9-17(26)SW-I-A.pdf)
- Mills, M. J. 1986. Alaska statewide sport fish harvest studies. Alaska Department of Fish and Game, Federal Aid in Fish Restoration, Annual Performance Report 1985-1986, Project F-10-1(27)RT-2, Juneau. [http://www.adfg.alaska.gov/FedAidPDFs/FREDf-10-1\(27\)RT-2.pdf](http://www.adfg.alaska.gov/FedAidPDFs/FREDf-10-1(27)RT-2.pdf)
- Mills, M. J. 1987. Alaska statewide sport fisheries harvest report, 1986. Alaska Department of Fish and Game, Fishery Data Series No. 2, Juneau. <http://www.adfg.alaska.gov/FedAidPDFs/fds-002.pdf>
- Mills, M. J. 1988. Alaska statewide sport fisheries harvest report, 1987. Alaska Department of Fish and Game, Fishery Data Series No. 52, Juneau. <http://www.adfg.alaska.gov/FedAidPDFs/fds-052.pdf>
- Mills, M. J. 1989. Alaska statewide sport fisheries harvest report, 1988. Alaska Department of Fish and Game, Fishery Data Series No. 122, Juneau. <http://www.adfg.alaska.gov/FedAidPDFs/fds-122.pdf>
- Mills, M. J. 1990. Harvest and participation in Alaska sport fisheries during 1989. Alaska Department of Fish and Game, Fishery Data Series No. 90-44, Anchorage. <http://www.adfg.alaska.gov/FedAidPDFs/fds90-44.pdf>

REFERENCES CITED (Continued)

- Mills, M. J. 1991. Harvest, catch, and participation in Alaska sport fisheries during 1990. Alaska Department of Fish and Game, Fishery Data Series No. 91-58, Anchorage. <http://www.adfg.alaska.gov/FedAidPDFs/fds91-58.pdf>
- Mills, M. J. 1992. Harvest, catch, and participation in Alaska sport fisheries during 1991. Alaska Department of Fish and Game, Fishery Data Series No. 92-40, Anchorage. <http://www.adfg.alaska.gov/FedAidPDFs/fds92-40.pdf>
- Mills, M. J. 1993. Harvest, catch, and participation in Alaska sport fisheries during 1992. Alaska Department of Fish and Game, Fishery Data Series No. 93-42, Anchorage. <http://www.adfg.alaska.gov/FedAidPDFs/fds93-42.pdf>
- Mills, M. J. 1994. Harvest, catch, and participation in Alaska sport fisheries during 1993. Alaska Department of Fish and Game, Fishery Data Series No. 94-28, Anchorage. <http://www.adfg.alaska.gov/FedAidPDFs/fds94-28.pdf>
- Minard, R. E., and M. Lisac. 1984. Togiak River sportfishing studies 1984. Alaska Department of Fish and Game, Division of Sport Fish, Dillingham.
- Sokal, R. R., and F. J. Rohlf. 1981. Biometry. 2nd edition. W. H. Freeman and Company, New York
- Walker, R. J., C. Olnes, K. Sundet, A. L. Howe, and A. E. Bingham. 2003. Participation, catch, and harvest in Alaska sport fisheries during 2000. Alaska Department of Fish and Game, Fishery Data Series No. 03-05, Anchorage. <http://www.adfg.alaska.gov/FedAidPDFs/fds03-05.pdf>
- Welander, A. D. 1940. A study of the development of the scale of Chinook salmon *Oncorhynchus tshawytscha*. Master's thesis. University of Washington, Seattle.

APPENDIX A: DAILY ANGLER COUNTS

Appendix A1.—Angler counts by day on the
lower Togiak River, 28 June to 19 July 2007.

Date	Count
28-Jun-07	11
29-Jun-07	Scheduled off
30-Jun-07	Scheduled off
1-Jul-07	24
2-Jul-07	32
3-Jul-07	46
4-Jul-07	37
5-Jul-07	20
6-Jul-07	Scheduled off
7-Jul-07	Scheduled off
8-Jul-07	35
9-Jul-07	48
10-Jul-07	50
11-Jul-07	30
12-Jul-07	21
13-Jul-07	Scheduled off
14-Jul-07	Scheduled off
15-Jul-07	33
16-Jul-07	38
17-Jul-07	22
18-Jul-07	18
19-Jul-07	30
